Space Weather Forecast

Issued on Sunday, 12 May 2024 at 13:10 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G4 (Severe) Geomagnetic storms expected with a Chance of G5 (extreme) Geomagnetic storms 12 May, conditions may continue 13 May but a general waning of activity expected through the period. Further R3 (Strong flares) likely.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has remained High in the past 24 hours, with X-ray activity showing frequent Moderate-class activity, peaking with a couple of Moderate flares from the large region in the southwest. There are currently nine sunspot groups on the disc, with a new region in the southeast. The region in the southwest is the largest and most magnetically complex region. There has been consolidation of the broader penumbral area and notable relative movement between the various mixed polarity spots, presenting large magnetic shear and further potential for large flares.

There are further Earth-directed coronal mass ejections (CMEs) that are due to arrive in the next 24 hours.

Solar Wind / Geomagnetic Activity: The solar winds have been enhanced over the past 24 hours following the two CME (coronal mass ejection) impacts late on the 10 May. Solar winds have been mostly at very strong levels throughout the period, with a peak of 996km/s at 12/0100 UTC, with a steady decline down to 830km/s, before a recent jump back up to 900km/s due to a weak CME arrival observed at 12/0855UTC. The magnetic field started the period at very strong levels, before a steady decline down to weak levels, although a recent jump to Moderate levels has been observed at 12/0855 UTC due to a weak CME arrival. The all-important north-south component also started the period strongly negative (southward) but has now become weakly positive (northward).

The net result of the above solar wind measures was an Extreme storm (G5/Kp9) interval observed at 11/1200-1500 UTC, with Severe storm (G4/Kp8) intervals between 11/1500-2100 UTC, declining to Strong Storm (G3/Kp7) between 11/2100-0000 UTC and 12/0000-0600 UTC, before finishing at the current Unsettled (Kp3) levels.

Energetic Particles / Solar Radiation: Solar radiation levels showed an upward trend initially in the wake of strong flares, with Minor storm levels being maintained.

Four-Day Space Weather Forecast Summary

Solar Activity: Further Strong flares are probable in the coming days with frequent Moderate flares expected, primarily from the large sunspot region in the southwest disc, but perhaps also contributed to from new eastern solar horizon arrivals.

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Solar Wind / Geomagnetic Activity: Recent CME arrivals have significantly increased geomagnetic activity and solar winds (strong to very strong) and further CMEs are expected to follow in the coming days. Two large flares from the large and complex sunspot in the southwest on 09 May resulted in Earth-directed CMEs. The faster, second CME is forecast to merge with the preceding CME resulting in a combined front arriving during Day 1 (12 May). Another much slower CME was observed leaving the sun following another large flare from the same region on 10 May. Another faster CME from the X5.8 flare is anticipated to impact the Earth later on Day 1 (12 May). A further CME associated with the M8.8 flare from the large sunspot in the southwest, observed at 11/1526 UTC, may arrive on the 13 May, but this is awaiting further analysis - pending results.

Geomagnetic activity has subsided in recent hours, down to Unsettled (Kp3) levels. Activity may become enhanced again following the expected combined arrivals of the two CMEs during Day 1, one of which, may have already arrived as a weak feature at L1. Peak G4/Strong-Severe levels of activity are likely through Day 1, with a chance of G5/Extreme activity following further CME enhancement, perhaps declining at times between CME impacts during Day 1. Activity expected to wane through Days 2 and 3 (13 and 14 May), however confidence at the end of the period is low and the forecast may change should further large Earth-directed CMEs occur.

Energetic Particles / Solar Radiation: Solar radiation levels are at S1/Minor Storm levels and should be maintained into Day 1 (12 May) at least, with a somewhat uncertain decline projected in the absence of any further significant flaring from the large sunspot in the southwest disc. The region is, however, moving into a more favourable location for proton response in the coming days. There is a chance of S2/Moderate or greater levels on Days 1 and 2 (11 and 12 May) reducing to a slight chance on the remaining days, although this could change following any further large flares from this region.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	100	70	50	20
Strong	G3	Yes	100	40	10	1
Severe	G4	Yes	95	30	1	1
Extreme	G5	Yes	50	20	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	95	95	90	40
Very Active	R3 to R5 X	No	60	60	50	20

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	Yes	100	60	40	20
Very Active	≥ S3 *	No	25	15	10	5

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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